

Related Occupations

Dental laboratory technicians fabricate artificial teeth, crowns and bridges, and orthodontic appliances, following specifications and instructions provided by dentists. Other workers who make and repair medical devices include dispensing opticians, ophthalmic laboratory technicians, orthotists and prosthetists, and precision instrument and equipment repairers.

Sources of Additional Information

For a list of accredited programs in dental laboratory technology, contact:

➤ Commission on Dental Accreditation, American Dental Association, 211 E. Chicago Ave., Chicago, IL 60611. Internet: <http://www.ada.org>

For information on requirements for certification, contact:

➤ National Board for Certification in Dental Technology, 1530 Metropolitan Blvd., Tallahassee, FL 32308. Internet:

<http://www.nadl.org/html/certification.html>

For information on career opportunities in commercial laboratories, contact:

➤ National Association of Dental Laboratories, 1530 Metropolitan Blvd., Tallahassee, FL 32308. Internet: <http://www.nadl.org>

General information on grants and scholarships is available from dental technology schools.

Inspectors, Testers, Sorters, Samplers, and Weighers

(O*NET 51-9061.01, 51-9061.02, 51-9061.03, 51-9061.04, 51-9061.05)

Significant Points

- For workers who perform relatively simple tests of products, a high school diploma is sufficient; experienced production workers fill more complex inspecting positions.
- Employment is expected to decline, reflecting the growth of automated inspection and the redistribution of quality-control responsibilities from inspectors to other production workers.

Nature of the Work

Inspectors, testers, sorters, samplers, and weighers ensure that your food will not make you sick, your car will run properly, and your pants will not split the first time you wear them. These workers monitor or audit quality standards for virtually all manufactured products, including foods, textiles, clothing, glassware, motor vehicles, electronic components, computers, and structural steel. As quality becomes increasingly important to the success of many production firms, daily duties of inspectors have changed. In some cases, their titles also have changed to *quality-control inspector* or a similar name, reflecting the growing importance of quality. (A separate statement on construction and building inspectors appears elsewhere in the *Handbook*.)

Regardless of title, all inspectors, testers, sorters, samplers, and weighers work to guarantee the quality of the goods their firms produce. Job duties, even within one company, vary by the type of products produced or the stage of production. Specific job duties also vary across the wide range of industries in which these workers are found. For example, inspectors may check products by sight, sound, feel, smell, or even taste to locate imperfections such as cuts, scratches, bubbles, missing pieces, misweaves, or crooked

seams. These workers also may verify dimensions, color, weight, texture, strength, or other physical characteristics of objects. Machinery testers generally verify that parts fit, move correctly, and are properly lubricated; check the pressure of gases and the level of liquids; test the flow of electricity; and do a test run to check for proper operation. Some jobs involve only a quick visual inspection; others require a longer, detailed one. Sorters may separate goods according to length, size, fabric type, or color, while samplers test or inspect a sample taken from a batch or production run for malfunctions or defects. Weighers weigh quantities of materials for use in production.

Inspectors, testers, sorters, samplers, and weighers are involved at every stage of the production process. Some inspectors examine materials received from a supplier before sending them to the production line. Others inspect components, subassemblies, and assemblies or perform a final check on the finished product. Depending on the skill level of the inspectors, they also may set up and test equipment, calibrate precision instruments, repair defective products, or record data.

Inspectors, testers, sorters, samplers, and weighers rely on a number of tools to perform their jobs. Many use micrometers, calipers, alignment gauges, and other instruments to check and compare the dimensions of parts against the parts' specifications. They also may operate electronic equipment, such as measuring machines, which use sensitive probes to measure a part's dimensional accuracy. Inspectors testing electrical devices may use voltmeters, ammeters, and oscilloscopes to test insulation, current flow, and resistance.



An inspector collects grain samples for testing.

Inspectors mark, tag, or note problems. They may reject defective items outright, send them for repair or correction, or fix minor problems themselves. If the product is acceptable, inspectors may screw on a nameplate, tag it, stamp it with a serial number, or certify it in some other way. Inspectors, testers, sorters, samplers, and weighers record the results of their inspections, compute the percentage of defects and other statistical measures, and prepare inspection and test reports. Some electronic inspection equipment automatically provides test reports containing these inspection results. When defects are found, inspectors notify supervisors and help analyze and correct the production problems.

Increased emphasis on quality control in manufacturing means that inspection is more fully integrated into the production process than in the past. For example, some companies have set up teams of inspection and production workers to jointly review and improve product quality. In addition, many companies now use self-monitoring production machines to ensure that the output is produced within quality standards. Self-monitoring machines can alert inspectors to production problems and automatically repair defects in some cases. Many firms have completely automated inspection with the help of advanced vision systems, using machinery installed at one or several points in the production process. Inspectors in these firms calibrate and monitor the equipment, review output, and perform random product checks.

Working Conditions

Working conditions vary by industry and establishment size. As a result, some inspectors examine similar products for an entire shift, whereas others examine a variety of items. In manufacturing, it is common for most inspectors to remain at one workstation; in transportation, some travel from place to place to do inspections. Inspectors in some industries may be on their feet all day and may have to lift heavy objects, whereas, in other industries, they sit during most of their shift and do little strenuous work. Workers in heavy manufacturing plants may be exposed to the noise and grime of machinery; in other plants, inspectors work in clean, air-conditioned environments suitable for carrying out controlled tests.

Some inspectors work evenings, nights, or weekends. Shift assignments generally are made on the basis of seniority. Overtime may be required to meet production goals.

Employment

Inspectors, testers, sorters, samplers, and weighers held about 602,000 jobs in 2000. About 7 out of 10 worked in manufacturing establishments that produced such products as industrial machinery and equipment, motor vehicles and equipment, aircraft and parts, primary and fabricated metals, electronic components and accessories, food, textiles, and apparel. Inspectors, testers, sorters, samplers, and weighers also were found in personnel supply services, transportation, wholesale trade, engineering and management services, and government agencies.

Training, Other Qualifications, and Advancement

Training requirements vary, based on the responsibilities of the inspector, tester, sorter, sampler, or weigher. For workers who perform simple "pass/fail" tests of products, a high school diploma is preferred and may be required for some jobs. Simple jobs may be filled by beginners provided with in-house training. Training for new inspectors may cover the use of special meters, gauges, computers, or other instruments; quality-control techniques; blueprint reading; safety; and reporting requirements. There are some postsecondary training programs in testing, but many employers prefer to train inspectors on the job.

Complex precision-inspecting positions are filled by experienced assemblers, machine operators, or mechanics who already have a thorough knowledge of the products and production processes. To advance to these positions, experienced workers may need training in statistical process control, new automation, or the company's quality assurance policies. As automated inspection equipment becomes more common, computer skills are increasingly important.

In general, inspectors, testers, sorters, samplers, and weighers need mechanical aptitude, math and communication skills, and good hand-eye coordination and vision. Advancement for these workers frequently takes the form of higher pay. They also may advance to inspector of more complex products, supervisor, or related positions, such as purchaser of materials and equipment.

Job Outlook

Like many other occupations concentrated in manufacturing industries, employment of inspectors, testers, sorters, samplers, and weighers is expected to decline through the year 2010. The projected decline stems primarily from the growing use of automated inspection and the redistribution of quality-control responsibilities from inspectors to production workers. In spite of declining employment, numerous job openings will arise due to turnover in this large occupation. Many of these jobs, however, will be open only to experienced production workers with advanced skills.

Employment of inspectors, testers, sorters, samplers, and weighers will be significantly affected by the increased focus on quality in American industry. The emphasis on quality has led manufacturers to invest in automated inspection equipment and to take a more systematic approach to quality inspection. Continued improvements in technologies, such as spectrophotometers and computer-assisted visual inspection systems, allow firms to effectively automate simple inspection tasks, increasing worker productivity and reducing the demand for inspectors. As the price of these technologies continues to decrease, they will become more cost effective and will be more widely implemented in a broad range of industries.

Apart from automation, firms are improving quality by building it into the production process. Many inspection duties are being redistributed from inspectors, testers, sorters, samplers, and weighers to other production workers who monitor quality at every stage of the process. In addition, the growing implementation of statistical process control is resulting in smarter inspection. Using this system, firms survey the sources and incidence of defects so that they can better focus their efforts and reduce production of defective products.

In many industries, however, automation is not being aggressively pursued as an alternative to manual inspection. Where key inspection elements are oriented toward size, such as length, width, or thickness, automation may play some role in the future. But where taste, smell, texture, appearance, fabric complexity, or product performance is important, inspection will probably continue to be done by humans. Employment of inspectors, testers, sorters, samplers, and weighers is expected to increase in the rapidly growing personnel supply services industry, as more manufacturers and industrial firms hire temporary inspectors to increase the flexibility of their staffing strategies, and in wholesale trade.

Earnings

Median hourly earnings of inspectors, testers, sorters, samplers, and weighers were \$12.22 in 2000. The middle 50 percent earned between \$9.26 and \$16.55 an hour. The lowest 10 percent earned less than \$7.33 an hour; the highest 10 percent earned more than \$22.21 an hour. Median hourly earnings in the industries employing the largest number of inspectors, testers, sorters, samplers, and weighers in 2000 were:

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| Motor vehicles and equipment | \$21.50 |
| Aircraft and parts | 17.00 |
| Electronic components and accessories | 11.55 |
| Miscellaneous plastics products, not elsewhere classified | 11.24 |
| Personnel supply services | 8.25 |

Related Occupations

Other inspectors include construction and building inspectors, who examine buildings and other structures to ensure compliance with building codes, zoning regulations, and contract specifications.

Sources of Additional Information

For general information about inspectors, testers, sorters, samplers, and weighers, contact:

► The American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203. Internet: <http://www.asq.org>

Jewelers and Precious Stone and Metal Workers

(O*NET 51-9071.01, 51-9071.02, 51-9071.03, 51-9071.04, 51-9071.05, 51-9071.06)

Significant Points

- About 30 percent of all jewelers are self-employed.
- Jewelers usually learn their trade in vocational or technical schools, through correspondence courses, or on the job.
- Although employment is expected to experience little or no change, prospects should be excellent; as more jewelers retire, many employers have difficulty finding and retaining workers with the right skills.

Nature of the Work

Jewelers use a variety of common and specialized handtools to design and manufacture new pieces of jewelry; cut, set, and polish stones; and repair or adjust rings, necklaces, bracelets, earrings, and other jewelry. Jewelers usually specialize in one or more of these areas, and may work for large jewelry manufacturing firms or small retail jewelry shops, or may open their own business. Regardless of the type of work done or the work setting, jewelers require a high degree of skill, precision, and attention to detail.

Some jewelers design or make their own jewelry. Following their own designs, or those created by designers or customers, they begin by shaping the metal or by carving wax to make a model for casting the metal. The individual parts then are soldered together, and the jeweler may mount a diamond or other gem, or engrave a design into the metal. Others do finishing work, such as setting stones, polishing, or engraving. Typical repairwork includes enlarging or reducing ring sizes, resetting stones, and replacing broken clasps and mountings. In manufacturing, jewelers usually specialize in a single operation. *Mold and model makers* create models or tools for the jewelry that is to be produced. *Assemblers* connect by soldering or fusing the metal and may set stones. *Engravers* may etch designs into the metal, and *polishers* polish the metal and stones to perfect the piece. In small retail stores or repairshops, jewelers may be involved in all aspects of the work. Jewelers who own or manage stores or shops also hire and train employees; order, market, and sell merchandise; and perform other managerial duties.



Jewelers and precious stone and metal workers must have excellent hand-eye coordination.

Jewelers typically do the handiwork required in producing a piece of jewelry, while *gemologists* study the quality, characteristics, and value of gemstones. Gemologists usually sell jewelry and provide appraisal services. A few gemologists are employed by insurance companies that offer their own appraisal services for those customers who wish to insure certain pieces of jewelry. Many jewelers also study gemology in order to become familiar with the physical properties of the gemstones with which they work, so that they do not unknowingly damage stones while setting and polishing them.

Although the quality of a piece of jewelry is the direct reflection of a particular jeweler's skills, and many procedures have been performed the same way for hundreds of years, new technology is helping to produce higher quality pieces of jewelry at a reduced cost and in a shorter amount of time. A growing number of jewelers use lasers for cutting and improving the quality of stones, intricate engraving or design work, and identification (ID) inscription. Jewelers also use lasers to weld metals together in milliseconds with no seams or blemishes, improving the quality and appearance of the jewelry. Some manufacturing firms use computer-aided design and manufacturing (CAD/CAM) to facilitate product design and automate some steps in the mold- and model-making process. CAD allows a jeweler to create a virtual reality model of a piece of jewelry, modify the design, and find mistakes, all on the computer screen. Once a jeweler is satisfied with the model, CAM produces the model in a wax-like material. Once the model is made, it is easier for manufacturing firms to produce numerous pieces of the jewelry, which are distributed to different retail establishments across the country.

Working Conditions

A jeweler's work involves a great deal of concentration and attention to detail. Working on precious stones and metals while trying to satisfy customers' and employers' demands for speed and quality can cause fatigue or stress. However, the use of more ergonomically correct jewelers' benches has eliminated the strain and discomfort formerly caused by spending long periods bending over a workbench in one position. In larger manufacturing plants and some smaller repairshops, chemicals, sharp or pointed tools, and jewelers' torches pose potential safety threats and may cause injury if proper care is not taken; however, most dangerous chemicals have been replaced with synthetic, less toxic products to meet safety requirements.

In repairshops, jewelers usually work alone with little supervision. In retail stores, on the other hand, they may talk with customers about repairs, perform custom design work, and even do some sales